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Iron and Steel Foundry Industries in Wartime

Statistics for which we have been asking for the last quarter of a century have at last become available in a publication issued by the British Iron and Steel Federation. In co-operation with the Joint Iron Council the production figures for iron castings made during the war are now released. The period covered—1940 to 1944—is one which shows a decreased output as compared with peacetime, yet the figures are impressive. In 1940, the total production was of the order of two and three-quarter million tons, falling to about 2¼ million in 1941, 1942 and 1943. In 1944 it was just over 2 millions. Thus, if in 1938 the average price of castings was only £15 a ton, then the annual turnover of the industry must have been of the order of £45,000,000. The changeover to war production is clearly shown by the statistics, for whilst there was a heavy reduction in the manufacture of pipes, baths, stoves, hollow-ware, tunnel segments, and miscellaneous castings, there was an output which reached its maximum in 1944 of 333,000 tons of direct munition work. An outstanding feature has been the steady increase during the war of castings destined for the production of cranes, lifting and conveying appliances, the gain registered being from 14,800 to 36,500 tons per annum. The extent to which the ironfoundry industry has been engaged on war work is well illustrated by Table 41. Throughout the war period Government contracts absorbed no less than 98 per cent. of the total output. Even the 2 per cent. would be mainly absorbed in providing spare parts for agricultural and industrial machinery. This is indeed a record of which the industry may well be proud. From the metallurgical aspect, it is worthy of note that in 1940 the industry used a 50 : 50 mixture of pig and scrap; the next year, 47 : 53, whilst in 1943 it was reduced to 45 : 55. By 1944 the percentage was nearly back to normal. The yield of castings per ton of materials charged was 73 per cent. in 1940; 74 in 1941, and ever since has been of the order of 70 per cent.

Turning to steel castings, the growth of this section of the industry is particularly noteworthy. It is not many years ago since the production was of the order of 120,000 tons per annum. The war saw the output rise from 285,000 to 616,000 tons in 1943, declining in 1944 to 588,700 tons. It is interesting to note that there are exactly 100 Tropenas converters in the steel industry, the majority of which make castings. Next in importance is the electric furnace which produces the major quantity of alloyed castings. Impetus was given to this method of production during the first war, when the output rose from 2,000 tons in 1915 to 46,000 in 1918. This figure was not attained again until 1937, when 60,000 tons was made. From that year onwards there has been a steady extension until in 1943, the output was 268,000 tons. About 15 per cent. of the production of steel castings is now alloyed and we anticipate this ratio to be materially increased during the next few years. It would appear that the normal turnover of the steel foundry industry is of the order of £7,500,000 to £10,000,000 a year.

To complete the picture there is need for the publication of similar statistics for the non-ferrous foundry sections. By totalling up all the various branches we think it would be possible to show that the manufacture of castings assumes an importance comparable with any of the other basic industries in this country. It is not unreasonable to assume that the origin of the statistics for the ironfoundry industry is the Ministry of Supply and we at least feel grateful to this department for giving the world for the first time a complete picture of its size and activities.

A LETTER RECEIVED FROM Mr. D. D. McGuffee makes the unique claim that his record shows that he was the first to make steel in Burma, Greece and the Irish Free State.

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NOTES FROM THE BRANCHES

SCOTTISH BRANCH.—At the opening meeting of the Scottish branch, held in the Royal Technical College, Glasgow, there was a large attendance of members. Mr. D. H. Young, past-president of the branch, occupied the chair, in the unavoidable absence of the retiring president, Mr. Tyrie, who has been incapacitated for several months by illness. It was agreed to send a message of goodwill from the members to Mr. Tyrie, who is now slowly recovering. Mr. Young welcomed Capt. Tom Shanks and Capt. John Cameron, who had now returned from military service and were present in the meeting. He was particularly glad to see Capt. Shanks, who had been a prisoner of war since Dunkirk and had, throughout all these years, been held as senior vice-president of the branch. Mr. Young voiced the minds of the members when he welcomed Mr. Alex. Marshall as the new president. Mr. Marshall, said the chairman, was well fitted by temperament, training and experience for his new position.

On taking the chair, Mr. Marshall thanked the members for his election, and asked for their support through what were likely to be the difficult years of the early post-war period. Before reading his presidential address, he congratulated Mr. James McKinstry on winning the McInnes-Shaw Medal for the work he had done at the Stow College last session, and then called upon Mr. John Cameron, who presented Institute diplomas to Mr. Wm. Montgomery and Mr. John Doig, Leven, awarded to them for their joint Paper on "Methods and Problems Indigenous to a General Engineering Foundry," which was read before the Falkirk section of the branch on October 27, 1944.

Mr. Marshall, in the course of his address, referred at some length to the difficulties consequent on the transition from war to peace. A strong appeal was made to the youth of the industry to take advantage of the present educational facilities and especially to develop a sense of leadership. Touching on the problem of the training of personnel for post-war jobs, the president said the industry and the Institute must support with enthusiasm any scheme introduced to find work which would restore confidence and dignity to the disabled ex-service men or women who were engaged in it. Ingenuity, care, forethought, and an urge to help—an urge to make the experiment work—were the secrets of success. The disabled, often shocked into apathy, and not always brave and resolute in themselves, must be gently led to realise that they were not finished, not useless, that their contribution to the world's work was not inferior to that of other more fortunate people. Referring to research, it said a great deal for the industry that the challenge by the totalitarian countries had been met with courage and determination and the Institute had played its part in this work. In the first place, it had done a great deal in convincing individual units within the industry that the pooling of scientific information was not a loss to the individuals who gave it, but that it was the gain of the industry as a whole, and that the gain of the industry was the gain of every individual composing it. Mr. Marshall concluded his address with a quotation from the American essayist Emerson which eulogised the recuperative power and self-confidence of the British people.

After the presidential address had been given, the Paper by Prof. Shestopal, of Moscow, was read by Mr. D. H. Young, who dealt with and explained the various points very thoroughly. There was no time for discussion, but the president, remarking that the Paper would be published soon, said members could send any comments to the branch secretary or to THE FOUNDRY TRADE JOURNAL. A vote of thanks to Mr. Young brought the meeting to a close.

FALKIRK SECTION.—The smoking room of the Temperance Café in Falkirk held a capacity audience on October 26, when a discussion took place on "Mechanisation with Respect to Light Castings." Mr. Thomas R. Goodwin presided, and in his opening remarks introduced Mr. John W. Gardom, of Ripley, president of the Institute, who had kindly agreed to lead the discussion in a form of "one-man brains trust." Many questions were then put to the meeting, and answered by Mr. Gardom. As was to be expected from a Scottish audience, questions included some relative to costs, as well as to materials used, principles of operation, types of machinery, etc. At the close of the discussion, the president was accorded a cordial vote of appreciation from the audience, each member of which seemed to be very pleased by the clear and racy manner in which Mr. Gardom dealt with questions put to him. Indeed, mechanically-aided planned production did not seem after the meeting the vast project it had hitherto represented. In bringing the evening's proceedings to a close, the chairman thanked Mr. Gardom for the spirit with which he had entered the discussion, although many of the questions must have been put to him on many previous occasions.

PAPERS FOR INSTITUTE'S 1946 MEETING

The Council of the Institute of British Foundrymen are prepared to receive offers of Papers to be presented at the annual meeting to be held at Birmingham in June, 1946. Authors intending to submit manuscripts should inform the acting secretary at St. John Street Chambers, Deansgate, Manchester, 3, as soon as possible, and should submit their manuscripts not later than January 31, 1946.

THE WHESSOE FOUNDRY & ENGINEERING COMPANY, LIMITED, propose to create 250,000 4 per cent. redeemable cumulative preference £1 shares and to make an immediate issue of 150,000 shares at par. The board also propose to sub-divide the ordinary £1 shares into 5s. units, in order to widen the market. A further proposal is to change the name of the company to Whessoe, Limited.

A NEW METHOD OF INVESTIGATING THE BEHAVIOUR OF CHARGE MATERIAL IN AN IRON-FOUNDRY CUPOLA AND SOME RESULTS OBTAINED*

Record of results of certain tests carried out on somewhat unorthodox lines which may help to solve individual problems

By N. E. RAMBUSH and G. B. TAYLOR

Introduction

Much has been written concerning the process of melting iron in the cupola, but little practical evidence concerning the mechanism of the process appears to be available. The Authors are of the opinion that, in the main, the work of former investigators and the beliefs of many foundrymen have been based on the assumption that certain pre-supposed conditions of combustion and metallurgical reactions exist inside the cupola and that these assumptions are not based upon any direct or practical evidence. Taken as a whole, the work of most former investigators on the enigma of what takes place inside a cupola appears to be correct, and it is not proposed in this Paper to dispute their findings concerning the intricate metallurgical reactions that take place inside the cupola, but rather to place on record the results of certain tests carried out on somewhat unorthodox lines and which may provide a clue to the solution of several practical melting problems.

Everybody is anxious to improve his cupola operating efficiency and the majority of foundrymen already know the lines along which improvement is desirable in their own plant. It is hoped that the present observations will be of interest to them and of assistance in case they desire to apply the testing method here described in trying to solve their own individual cupola melting problems. It is also hoped that others will carry these investigations further because it is felt that the work is incomplete, and that much more evidence and information of practical value could be obtained from tests made in other cupolas on similar lines to this method of research.

Need for Investigation

Due to wartime scarcity of certain qualities of pig-iron, iron and steel scrap, as well as of metallurgical coke, it became necessary, in the foundry with which the Authors are connected, to alter the standard mixes used in their plant. One of the immediate difficulties was that, with the grades of pig-iron that were allocated to them, the input of carbon in the metal charge (which in normal practice always contains a certain proportion of steel) was lower than formerly. Furthermore, an unaccustomed irregularity of the carbon content in the melt was experienced. For some time experiments along orthodox lines were made to obtain a higher and more regular carbon content, but all the adjustments in the metal mixture, coke to metal ratio, bed height and blast volumes, etc., failed to produce the desired result. Consequently, it was thought justifiable to obtain a practical confirmation of some of the theories hitherto accepted as underlying cupola operation.

Principle of Investigation

It is thought that the principle employed in the present investigations has not been adopted before in cupola research, although one of the Authors had previously used a somewhat similar procedure when conducting some research on producer-gas reactions. It was felt that if the combustion and metallurgical reactions in a fully charged cupola could suddenly be stopped and samples from different parts of the charges or burden could simultaneously be removed, the composition and condition of these samples would provide at least some of the information needed. The information required would be analogous to that obtained by a cinematograph projector where, by stopping the machine suddenly, one can examine the details of each individual picture at leisure. So far as cupola operation is concerned, such conditions are difficult of attainment and a more practical method had to be found.

In order to stop the normal cupola reactions and to cool the burden before removing the samples, it was decided to quench or chill, as quickly as possible, the whole normal working charge by simultaneously shutting off the blast and pouring in water on top of the burden through the charging door. It was found that the charge can be rendered inert by water cooling in less than 40 minutes, which is the approximate time when unevaporated water commences to run out of the bottom plate of the cupola.

As the possibility of scalding the operators was feared, certain special precautions were taken on the

*A Paper read at the 42nd annual meeting of the Institute of British Foundrymen, held in London, June 15 and 16, 1945. The Authors are managing director and foundry manager respectively of Ashmore, Benson, Pease & Company, Limited, of Stockton-on-Tees.

Behaviour of Charge Material

occasion of the first test, but it may be stated that after adopting the water-quench method on several occasions, any trepidations felt in the initial stages of the research were quite unjustified; nor did any untoward incident occur. It was found, however, that a certain amount of pressure built up in the lower part of the cupola, causing steam to blow from the tuyere jointing wherever such joints were improperly made. A few hours after commencing to extinguish the fire in the cupola the charge is ready for removal piecemeal from the top downwards, and it is the observation of the appearance and composition of these pieces that is the main basis of this Papar. Initially attention was confined solely to observations concerning the mechanism relating to carbon pick-up by the steel in the charge, but immediately after the first test it was realised that there were many other immediate and practical observations which could be made.

The results here given are an accumulation of evidence obtained from making four such tests on, as far as practical, identical cupola charges. These tests were made on November 1, 1943, April 6, August 18 and October 6, 1944. The majority of tests were carried out at times when complete re-lining or special repair of the cupola lining were required because, at first, it was feared that the chilling effect of the water would so damage the lining as to make re-lining essential.

In the earlier tests many factors were brought to light which evidently required more stringent control

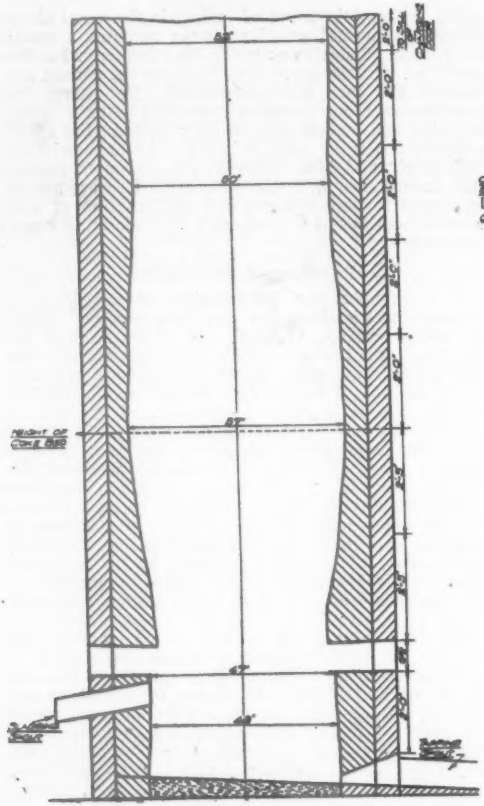

FIG. 1.—SECTION THROUGH CUPOLA CHOSEN FOR TESTING.

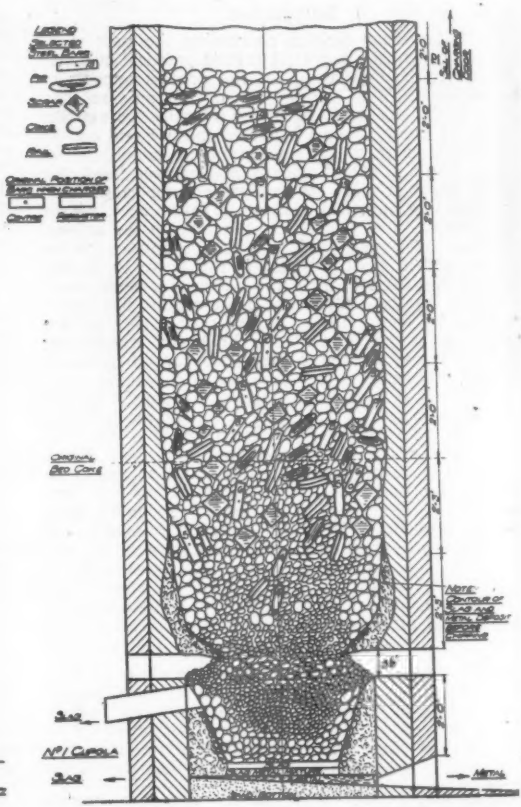

FIG. 2.—GRAPHIC REPRESENTATION OF CONDITIONS DURING A BLOW.

and examination than anticipated, therefore the later tests are regarded as being more reliable. Nevertheless, in all tests so far carried out the general conclusions drawn were largely identical and gave what is believed to be a more or less satisfactory answer to the following:—

(1) In which location of the cupola zones does the steel in the charge commence to pick up carbon?

(2) The progressive degree of carbon pick-up before the steel is completely molten.

(3) Does the absorption of carbon by the steel take place in the liquid, pasty or solid state?

(4) How much sulphur (if any) does the steel pick up from the coke charge?

(5) Does the coke alter appreciably in size as the burden descends?

FIG. 3.—TOP OF THE CHARGE BEFORE STRIPPING.

Size of coke is unaltered; some coke pieces appear darker than others, probably due to water quenching resulting in uneven settling of the fine dust. One piece of metal is visible. The white material is limestone. Note the abrasion of the brickwork near the charging level.

(6) Do the pieces of the bed coke alter in size?

(7) Is there any difference between bed coke above and below the tuyeres?

(8) Do the individual pieces of metal in each charge descend to the melting zone in the same position relative to each other as originally charged?

(9) What is the location and shape of the "melting zone"?

Preparation for Test

It was decided that the test should be carried out on a charge consisting of the same materials as in the normal melt used at the end of the day's heat, *viz.*, approximately 30 per cent. pig, 60 per cent. scrap, and 10 per cent. steel. Coke and limestone added amounted to 17.8 and 5.3 per cent. of the metal charge respectively.

The normal steel scrap in use by the Authors consists of fishplates and rails, but as it was found that individual fishplates varied considerably in their carbon content (between 0.05 and 0.5 per cent.), it was decided to cut out test-pieces from new flat bar stock of approximately the same dimensions. These flat bars, on analysis, gave an initial carbon content of between 0.20 and 0.23 per cent. Two pieces were chosen for inclusion in each charge for special observation and marked in a manner to enable them to be recognised at any stage before complete melting; they were then placed flat on top of the charge, one piece in the centre and one against the wall of the cupola.

Since the coke alters in size as melting of the charge proceeds, all coke was screened, including that in the original coke bed, so as to obtain a size of between 4 and 6 in.

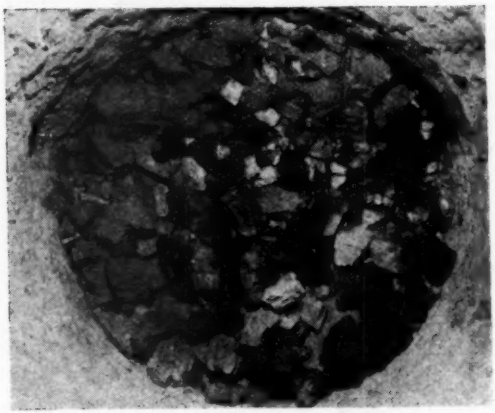

FIG. 4.—FOUR FEET BELOW THE LEVEL OF THE SILL.

Visually, no change in the size of coke has taken place. Limestone is still visible. The brickwork abrasion is negligible. The small hole at the left is the take-off for the CO_2 recorder.

As the selected cupola (42 in.) takes about ten charges of metal and coke when full to the charging sill, it was arranged that the last 14 charges of the day's heat should be specially controlled. All these charges were prepared well in advance and held ready on the cupola platform for use when required, and the heat so planned that, when the blast was ultimately shut off and melting stopped, the first two or three special charges would have melted completely and the cupola remain fully charged

A water supply pipe was arranged to deliver about 1,000 gall. per hr., the water being sprayed on to the cupola charge from a cone distributor arranged some 2 ft. above the charging door sill. With the object of

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arresting combustion between the time of shutting off the blast and finally quenching the bed, a slip plate was fitted between the blast main and the tuyere belt. Asbestos joints were also provided for the tuyere covers to render them airtight. A block and tackle with a bucket was provided for removing the cooled burden piecemeal through the charging door.

A drawing (Fig. 1) was made, setting out the lining dimensions at different locations before the day's melt was started and, by taking similar dimensions after the test, it was possible to establish the extent and location of the lining wear. It should be noted that the cupola bricks were worn so much by erosion in the upper part that re-lining was contemplated after the test. Arrangements were also made for taking

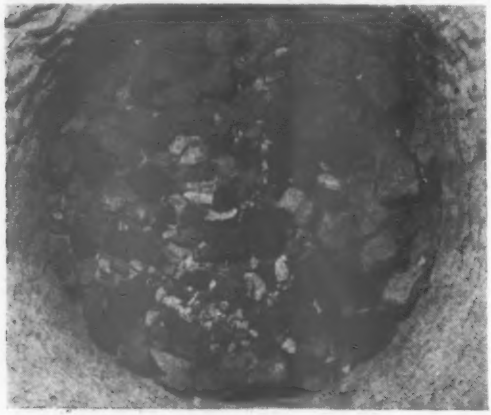

FIG. 5.—SIX FEET BELOW THE DOOR SILL.

No appreciable change in size or nature of coke is apparent, although some small coke can be seen. Limestone is visible.

a series of photographs of the coke at various stages of removing the charges, so as to obtain a permanent record of what the charge and bed coke looked like at these intermittent stages.

Procedure of Test

Table I shows a log of the experiment carried out on August 18, 1944. This speaks more or less for itself, but the following general remarks may be helpful. Blast was admitted at 11 a.m., and, except for a short period at midday, the cupola was in continuous operation until 2.30 p.m., melting various charges, some of which contained as much as 60 per cent. steel. The introduction of the 14 experimental charges was commenced at 2.30 p.m., and the last charge was made at 3.35 p.m., incidental with taking off the blast. At 3.35 p.m. the last tap for foundry use was taken and at 4.5 p.m. water quenching started. Water appeared at the cupola base at about 4.45 p.m., and the quenching was continued at reducing rates to 6.35 p.m. This time lag of approximately half-an-hour

TABLE I.—*Log of Experiments on Cupola No. 1 on August 18, 1944.*

Schedule of times:

Bed lit at	6.00 a.m.
Started charging	10.30 a.m.
Blast on	11.00 a.m.
First metal tap	11.35 a.m.
First experimental charge on	2.30 p.m.
Last (14th) experimental charge on	3.35 p.m.
Blast off	3.35 p.m.
Last tap and drain out	3.55 p.m.
Tuyeres, tap holes, etc., blanked off	4.05 p.m.
Commenced quenching	4.05 p.m.
First water drops appeared at bottom plate	4.45 p.m.
Cupola completely quenched	6.35 p.m.

Charges Used:

From 11.35 a.m. different mixes were melted, some containing as much as 60 per cent. mild steel until 2.30 p.m., when the following mix was in continuous use:—

	cwts.	qrs.	lb.
Shotts pig	3	0	0
Return scrap	3	0	14
Bought scrap	2	2	0
Ferro-silicon	0	1	14
Steel	1	0	0
Weight of charge	10	0	0

Coke per charge = 200 lb.
Limestone per charge = 60 „

Analysis of last tap	T.C	Si	S	P	Mn
	3.19	2.28	0.103	0.548	0.93

Records of Blast and Stack Gases:

Time.	Pressure.	Volume.	CO_2 in Stack Gases.
	In.	Cub. ft.	Per cent.
11.0 a.m.	16.0	4,250	18.0
11.30 „	21.0	4,450	10.0
12.0 noon	22.0	4,600	9.0
12.30 p.m.	Blast off	—	8.0
1.0 „	22.5	4,600	8.5
1.30 „	22.0	4,500	7.0
2.0 „	18.0	4,400	12.5
2.30 „	19.0	4,400	12.5
3.0 „	19.5	4,450	12.0
3.30 „	22.0	4,500	11.0
4.0 „	Blast off	—	7.0
4.30 „	„ „	—	3.5

Bed Coke at Start:

Size = 4 to 6 in. carefully graded.
Height = 54 in. from top level of tuyere.
Weight = 22 cwts.

between taking off the blast and commencing to water quench was longer than in the case of previous tests and should be reduced as much as possible. The following day the cupola was stripped of its charge, which proceeded in a remarkably clean manner. The special steel test-pieces in the charge were removed for analysis, the coke was collected and regraded, and dimensions were taken of the lining.

Observations on Stripping

Fig. 2 is a sectional elevation drawing of the cupola (same scale as Fig. 1), and it gives a diagrammatic picture of the charge materials and cupola walls as disclosed on stripping. The legend distinguishes the different constituents of the metallic charge, and an indication is given of the relative size of the coke at different depths of the charge.

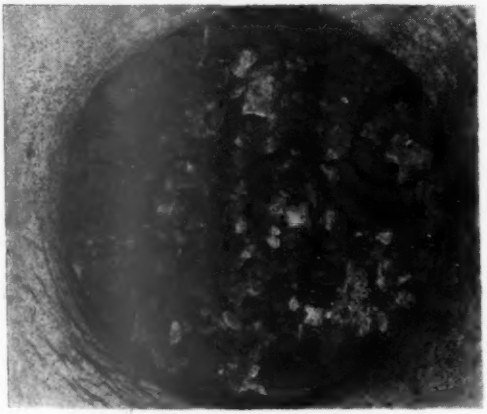

FIG. 6.—EIGHT FEET BELOW THE SILL.

An appreciable reduction in the size and a definite change in the nature of the coke can be observed. Larger coke is at the periphery, whereas the coke at the centre is small. Limestone has been whitened due to decomposition into CaO and CO_2.

Position and Nature of Metallic Charge

Great care had been taken during charging to ensure that all charges were made level, that the two steel test-pieces in each charge were placed on their flat side, one in the centre and one against the wall of the cupola, and that each metal charge was completely covered by its subsequent charge of coke.

On stripping it was found that the metallic charges had not descended as originally placed, but followed the path of least resistance. Although all steel test-pieces were placed on their flat sides in the shaft, all (with the exception of one of the No. 12 pieces) were found to have buried themselves vertically in the coke, in certain cases even descending so far away from their original position as to enter the next metal charge. A similar observation was made in regard to the pig-iron (not machine cast), all of which had been placed horizontally in the first instance; nevertheless, the pigs gradually assumed a more or less vertical position. As regards test-piece No. 12, this was found to have lodged itself against a ledge in the wall at the top of the cupola, an occurrence never experienced in any other test. Scrap, owing to its shape, seemed to remain as placed and slipped only when a gap of sufficient size was created, due to the movement of the burden.

No trace whatever could be found of Nos. 1, 2 and 3 steel test-pieces, and it must be assumed that these had melted completely. All other steel test-pieces (some of which were found in the coke bed itself) were carefully gathered together, and are referred to in detail. It is assumed that the fact that the steel pieces always travelled further than the scrap and pig is due to their higher melting temperature. At the bottom of the well a "sheet" of about 3 cwts. of solidified cast iron was found and was easily broken and removed by way of the bottom doors.

In all the tests there was a tendency for all materials in the lower part to move towards the centre of the cupola and this is mainly attributed to the fact that the formation of a "slag ledge" immediately above the tuyere level restricts edge flow and drives the active "melting zone" more and more towards the centre as the heat progresses. Observations made on the state of the metallic charge on the occasion of previous tests showed similar evidence except that, on one

TABLE II.—*Screen Tests on Coke After Removal.*

Location of Coke Layer in Feet below Sill of Charging Door.	Total Weight in lbs.	Over 4-in. Per cent.	Over 3 in. Per cent.	Over 2 in. Per cent.	Over 1½ in. Per cent.	Below 1½ in. Per cent.	Ash Content. Per cent.
2 ft. to 4 ft. ..	360	79.1	16.3	3.6	0.6	0.3	—
4 ft. to 6ft.	372	64.4	29.0	5.0	0.8	0.8	—
6 ft. to 8 ft. ..	457	48.6	36.7	11.6	1.7	1.4	—
8 ft. to 10 ft. ..	574	36.2	46.3	10.5	3.5	3.5	—
10 ft. to 12 ft. 3 in.	688	33.1	47.0	10.9	2.8	6.2	10.6
12 ft. 3 in. to 14ft. 6in.	1,372	20.7	36.8	16.8	6.8	19.9	10.0
In front of tuyeres ..	198	3.5	20.2	31.3	10.1	34.9	12.7
Below tuyeres ..	142	0.0	10.6	22.5	10.6	56.3	14.1

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occasion, when chunky pieces of ingot mould scrap were used instead of hematite pig, there seemed to be a tendency for these to accumulate at a point some 3 ft. above the tuyeres, which demonstrates that, due to their greater bulk, they had not melted completely and, at the same rate as the other cast-iron materials of the component charges.

From the foregoing the practical conclusion is drawn that, in preparing cupola charges, careful consideration must be given to the matter of selecting charge constituents with due regard to their shape and size so as to ensure that all components of each charge melt at a reasonably uniform rate. Where several different qualities of metal must be produced from the same cupola during the day's heat, correct sizing of charge materials having regard both to their shape and respective melting temperature is of paramount importance if "charge dilution" is to be reduced to a minimum.

State and Nature of Coke

As stated previously, all coke used throughout the entire day's heat was hand-picked and graded so that it all passed through a 6-in. mesh screen, whereas that passing through a 4-in. mesh screen had been discarded. A sample of the coke was taken for laboratory analysis, with the following results:—Composition: Fixed carbon, 89.86; volatile matter, 1.0; ash, 9.2; hydrogen, 0.31, and sulphur, 0.81 per cent.

	Shatter Test.	
	No. 1. Per cent.	No. 2. Per cent.
Per cent. retained on 4-in. mesh	64.7	78.9
" " " " 3-in. "	85.3	92.1
" " " " 2-in. "	94.1	96.8

After removing the metal charge the remaining coke was photographed* (Figs. 3 to 11). Each layer of coke removed *via* the charging door was screened, with the results shown in Table II.

A study of Table II in relation to Figs. 3 to 11 reveals a very considerable reduction in the size of the coke found in the cupola as compared with the coke as charged. This reduction of coke size is partly due to combustion and partly due to crushing caused by the weight and movement of the burden. It is also apparent that there is an increase in the weight of each succeeding coke layer down the stack until the top of the original coke bed is reached at about 10 ft. from the charging sill, indicating a gradual concentration or consolidation of the coke. This observation was confirmed in other tests and is assumed to be due to two factors:—

* The following photographic conditions were standardised to give optimum results. A circular platform with a 1-ft. dia. central hole was provided to support the camera (Zeiss Ikon "Contax" with f/2 Sonnar lens). The platform was movable up and down by pulley and tackle. A constant distance of 10 ft. between the lens and the separate charge layers was maintained. Artificial light provided by a 500-watt photoflood lamp with reflector was provided on the tapping hole side, 3 ft. from the camera and 7 ft. from the surface to be photographed. The film used was Kodak "Panotomic-X."

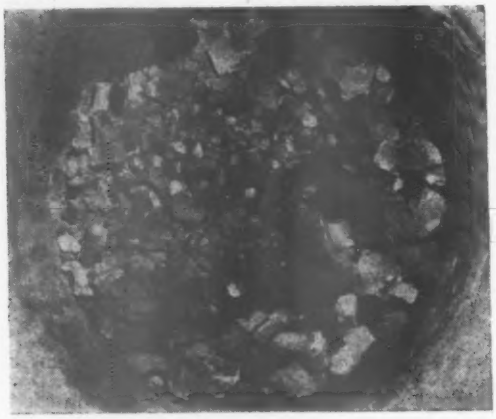

FIG. 7.—TEN FEET BELOW THE SILL.

A distinct reduction in the coke size is noticeable towards the centre, the larger pieces being at the periphery. A piece of metal is showing through the surrounding coke.

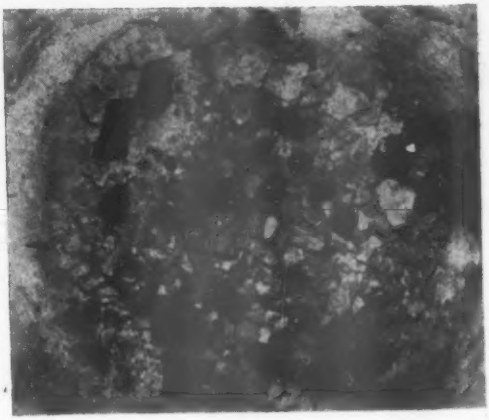

FIG. 8.—TWELVE FEET THREE INCHES BELOW THE SILL.

The small coke is in the centre and the large coke towards the periphery. Ash is present between the coke pieces as well as adhering to the walls. Here, also, the walls show evidence of having melted.

(1) A consolidation of the charge due to the weight of the burden, the reduction in coke size and possibly also to the flushing effect of the quench water; and (2) part melting and softening of some of the metallic charge at levels above the coke bed.

Generally speaking, it may be said that in the first 4 ft. of burden below the charging sill there was little change in the size of coke. Any slight reduction occurring here can be accounted for by normal breakage in handling. From the charging sill to 10 ft. below, *i.e.*, the top of the original coke bed, the reduction in size was progressive and occurred uniformly across the diameter of the furnace.

So far as concerns the coke bed proper, it was found that, between the plane marking the original height of the bed and the top of the tuyeres, the size of coke had been reduced to a still greater extent. Reduction in size of the coke in the bed proper was by no means uniform across the horizontal plane, as the size of the coke in the centre was reduced most, whilst the coke found against the walls of the cupola remained almost unaffected. This tendency of the coke to move in lines towards the centre is probably due to the formation of the "slag ledge" immediately above the tuyere level. Immediately in front of the tuyeres the size of coke was found to be very small. Signs of unfused ash were found throughout the whole coke bed. This ash was more or less evenly distributed. Judging from the ash analysis of the coke removed, it seems clear that the combustion of the coke takes place mainly on the outside thereof.

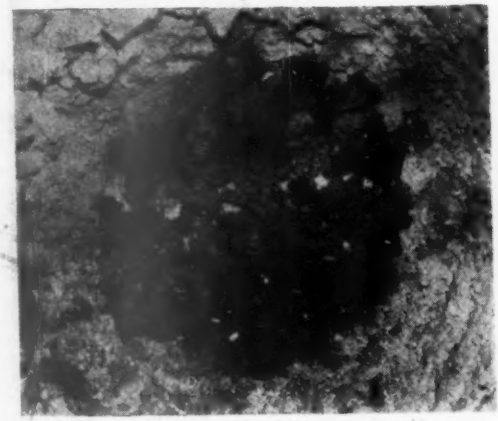

FIG. 9.—IMMEDIATELY ABOVE THE TUYERE LEVEL—THAT IS, 14 FT. 6 IN. BELOW THE SILL.

The general trend is for the small coke to be in the centre. Ash as well as limestone is visible. The tuyeres are not visible because of the "slag ledge"—a bridging over by a mixture of unburnt coke, slag, metal and ash. This "slag ledge" has decreased the active cross-section to about one-half.

Observations made on the condition of the coke bed on the occasion of previous tests show similar evidence except that on one occasion the depth of the coke bed appeared somewhat lower on the side above the slag hole. No doubt this was due to the practice of leaving the slag hole open during the latter part of the heat, thus allowing small pieces of bed coke to be blown out and to some extent increasing the combustion on that side of the cupola. This blowing out of bed coke may result in a certain unevenness in the melting of the charge over the cross-section of the cupola. Coke removed from the well was found to be of extremely small size, with more than 50 per cent. passing through a 1¼-in. mesh screen. Another interesting observation was that the size of coke immediately below tuyere level extending to a depth of approximately 8 in. proved to be of even smaller size than that found in the well generally, which suggests that, at some period, this coke had been in direct contact with the blast, resulting in partial combustion.

In view of previous observations on the subject of the size of coke (whether for charging or for the bed), it may be of interest to state the conclusions arrived at so far as the Authors' cupola practice is concerned.

FIG. 10.—APPROXIMATELY 15 FT. BELOW THE SILL—THAT IS, AT THE BOTTOM LEVEL OF THE TUYERES.

All tuyeres are free and accessible below the "slag ledge." The majority of the coke is now very fine and mixed with ash; some limestone or lime still appears.

There is no doubt that some, if not all, of the charge coke is reduced in size as it descends to the coke bed which it replaces. This fact does not justify one saying that there is no need to use an even and regular size of charge coke; indeed, it is important for regular operation to reduce all variables in the raw materials

Behaviour of Charge Material

to the minimum. The individual pieces in the coke bed, even though they may be uniform in size at the beginning of the heat, will not be evenly reduced in size, because the distribution of the air blast is more concentrated at the lines of air flow from the tuyeres than between the tuyeres themselves. Furthermore, the "slag ledge" immediately above the tuyeres restricts the free flow of material near the cupola walls.

A suitable depth of the original bed having once been decided upon, it should remain nearly constant so that no particle of unmelted metal can come in contact with free oxygen. The depth of the coke bed existing during melting would seem to be a function of the original depth arranged for and the rate of burning the superimposed charge coke. If these two factors are balanced, the depth will remain constant throughout the melt. A uniform size of coke in the original coke bed is desirable, so that even combustion is ensured before the blast is put on. Unless the cupola is of the continuous tapping type, the coke in the bed below the tuyeres floating in the molten iron and slag is lifted (or compressed), due to its buoyancy till it reaches the tuyere zones, where it becomes subject to intermittent burning.

Condition of Lining

The lining of the cupola under test consisted of refractory blocks backed with insulating bricks. To compensate for the lining wear in the lower part taking place during each heat, the "melting zone" was faced up with firebrick embedded in ganister; hence, before the test, the inner wall of the cupola was not perfectly straight from top to bottom. Table III gives the internal dimensions taken of the cupola shaft at different levels before and after the test.

TABLE III.—*Diameter of Lining.*

Location.	Before Test after Daubing.	After Test after Chipping.	Increase in Diameter.
	In.	In.	In.
1 ft. below tuyeres	48	48	Nil
Tuyere level ..	47	48	1
1 ft. above tuyeres	45	55	10
2 ft. " "	49½	56	6½
3 ft. " "	53	54	1
4 ft. " "	57	58	1
5 ft. " "	56	57	1
6 ft. " "	55	57	2
7 ft. " "	54	65	2
8 ft. " "	52	55	3
9 ft. " "	51	54	3
10 ft. " "	50	52	2
11 ft. " "	52	52	0
12 ft. " "	52	52	0
13 ft. " "	52	52	0
14 ft. " "	52	52	0

It will be seen that the maximum lining wear occurs just above the tuyeres, but decreases rapidly until a point is reached approximately 3 ft. above the tuyeres where the diameter of the cupola was increased by an almost negligible amount. Between 6 and 10 ft. above the tuyeres, wear appears to have taken place to a slight degree, the reason for which is not apparent at present. Above 10 ft. from tuyere level no evident wear had taken place.

As will be seen from Fig. 2, there was a considerable slag formation adhering to the wall of the cupola above, as well as below the tuyeres. The formation of slag above the tuyeres is no unusual occurrence, but the slag adherence below the tuyeres does not correspond with ordinary practice, so this formation has been attributed to the water quenching of the charge. The formation of the slag ledge or bridge above the tuyeres is one that must affect the location and position of the melting zone, because at the beginning of the day's heat no such slag ledge is in existence, while as the day's heat proceeds, the slag ledge increases, thus narrowing down the cross-sectional area available for combustion at the tuyere level. Most of the coke immediately above the slag ledge must remain more or less stationary, causing the main flow of the materials from above to take place through the central hole left by the slag ledge.

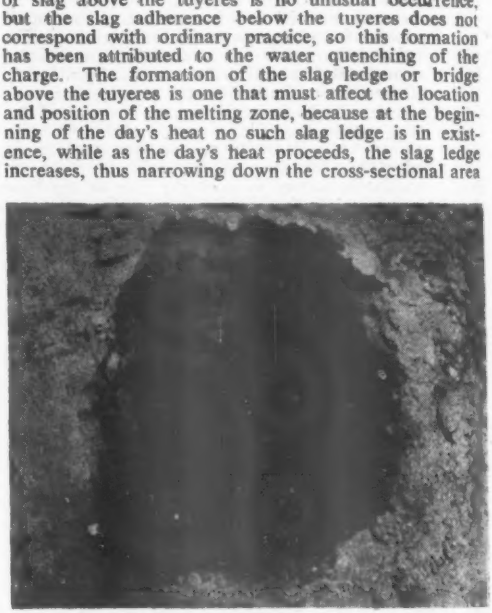

FIG. 11.—ONE FOOT BELOW THE LEVEL OF THE TUYERES.

Mainly small coke with ash dispersed throughout. From the bottom level of the tuyeres downwards towards the well bottom, a gradual build-up has taken place of a mass of coke, ash, slag and metal.

From this evidence it may be concluded that the location and shape of the melting zone varies during the day's heat, *viz.*, at the beginning of the heat it will

(*Continued on page* 212, *col.* 2.)

THE CAUSE AND CONTROL OF MICROPOROSITY IN MAGNESIUM ALLOYS

By E. A. G. LIDDIARD, M.A., and W. A. BAKER, B.Sc.

Discussion on a Paper presented at the annual meeting of the Institute of British Foundrymen. The Paper was printed in our issue of October 25 and November 1.

MR. A. J. MURPHY, M.Sc., said there was some danger that because practitioners in magnesium alloys spoke so freely and publicly of microporosity, others not so experienced might think it was an affliction, only affecting magnesium alloy castings. Magnesium alloys were by no means the only materials which exhibited that phenomenon. It was, perhaps, a reflection of the recent development of magnesium foundry work that many of its problems were approached in a detached scientific spirit that did not always surround discussions in the early days of some of the heavier metals. However, it was important to convey to the people interested in the ultra light metal castings that the industry had taken a realistic view of all these problems, and did not mind discussing them in the open. At the same time, they welcomed contributions from anybody who, in other fields of foundry work, might have derived some useful experience.

Many of those present had discussed this particular problem before in other places, and while not quarrelling in any way with the main contentions of the Authors, he had the impression that they tended to over-rate the importance of gas absorption. Gas absorption, in his view, was not a major problem in magnesium foundry work, and therefore he was sorry that the Authors had put it first among the factors which they thought should be considered. There was no doubt that gas did go into molten magnesium quickly, but it also came out quickly. If gases behaved in that way in all metals, foundry work would be a much simpler proposition. Mr. Liddiard had said that one factor which reduced the absorption of gas in molten magnesium alloys was that the melt was covered with flux, but he could not accept the suggestion that a flux covering would necessarily impede the absorption of gas; in the aluminium foundry one had seen melts which were saturated with gas, possibly because they were covered with flux.

Upward Feeding

He would like to direct the attention of those who had not already studied this Paper to a very interesting observation in it on upward feeding, *i.e.*, with the riser at the bottom of the casting being able to pass liquid metal to the solidifying parts above. That was of fundamental importance, and not only in magnesium work. Foundrymen had got so used to the idea that metal must run downhill under the influence of gravity, that there was a tendency to forget the very powerful capillary forces which would draw metal upwards. He was very appreciative of the work which the Authors had done, and the British Non-Ferrous Metals Research Association had reason to be proud of the part they had played in unravelling some of the problems of light metal foundry work.

The PRESIDENT (Mr. J. W. Gardom) remarked that there were many points in this Paper which could be considered irrespective of the particular material dealt with, and those who might discuss the later Papers at the meeting would also, perhaps, like to take part in this discussion also.

MR. G. L. BAILEY (Director, British Non-Ferrous Metals Research Association) said there was one remark he would like to make arising out of what Mr. Murphy had said, *viz.*, that just because it had been decided that a certain problem was worth investigation in the laboratory, it should not be argued that it was a much more trying and difficult problem on a much more awkward metal than were a great many problems which did not get the same publicity. The real answer was that the magnesium industry had been sufficiently anxious to do everything possible to get the best quality product, that it had given the Research Association every encouragement to publish the results obtained in investigating such things as were known to be troublesome in the foundry. Therefore, he would not like the mere fact that the Association had published a Paper on this subject to be regarded as an indication that this was a serious trouble which could not be dealt with in the foundry. It was dealt with to some extent, and very successfully dealt with, even before the work described in the Paper was done, and whereas he felt that explanations had been provided which would enable the foundry industry to make a still better job of it, the idea that magnesium was particularly awkward and difficult should not go unchallenged.

Merits of De-gassing

MR. MILLER said that, to the best of his knowledge, in the ordinary commercial working of magnesium in this country gas porosity did not appear to be a major issue. He did not think that many founders in Great Britain employed de-gassing methods either by chlorine or by chlorine-evolving compounds. On the other hand, a reference to current American literature suggested that at least two major foundries in the U.S.A. are using chlorine. Therefore, he wondered if, in the light of the work that had been carried out by the Authors and the check-up which they had naturally had with the industry generally in this country, there was anything to be said for de-gassing. As he saw the position in this country generally, gas in commercial practice did not appear to be a major problem, yet in America—judged solely by the literature—it did appear to be so.

A point which the Authors had emphasised was that gas porosity in magnesium, tended to exaggerate microporosity. On the other hand, in connection with aluminium alloys, he thought it was generally conceded that "gas" (hydrogen) in reasonable quantities would tend to distribute ordinary shrinkage porosity and not aggravate it, and he was wondering why there should be that major difference in the characteristics

Microporosity in Magnesium Alloys

of gas evolution in the case of the two metals—a light alloy and an ultra-light alloy. Was it because of the low heat capacity of magnesium and the consequent rather rapid solidification compared with aluminium?

MR. TIPPER asked for the Authors' opinion on the use of core coatings in the case of Elektron die castings. As a practical example, he mentioned some trouble experienced with porosity in fairly large gravity die castings. The blame was put on to the sand cores and a whole variety of types of core dressings were tried. The danger of surface reaction with core gases in this type of casting had been previously stressed or made use of to explain the microporosity, and no satisfactory method of overcoming it had been found. The core had a completely open centre and several chimney vents. To convince the foundry, a number of dressings were applied, including the usual types of talc with boric acid and ammonium bifluoride solution. A number of castings were also made without any coating at all on the cores, and these proved no worse than the others, microporosity was still present. Changing the core sand mixture, which contained normal proportions of inhibitor, also failed to overcome the microporosity. His own view was that chilling was the correct answer in order to promote progressive solidification. He would like the Authors' views on this. Obviously, it was difficult to control temperature gradients in a large die when the design was intricate.

As to the bottom feeding of castings, whilst, no doubt, all would agree with the theories expounded, he suggested that the use of atmospheric pressure feeding by the Williams or Taylor method, as applied to steel castings, would assist bottom feeding. He was glad to see the explanation by the Authors of the part played by a fine grain structure compared with a coarse grain in relation to cracking.

MR. HANCOCK congratulated the Authors on the manner in which they had carried out this work, but could not support what they had said with regard to upward feeding; he favoured downward feeding.

MR. F. H. SMITH said he was interested in the theory which had been postulated by the Authors for the formation of annular porosity in magnesium type alloys. It was explained that this was due to the hexagonal crystal formation of the material. There was a very wide field of investigation here, and he asked for further information on the point. Was this theory substantiated by the behaviour of other hexagonal lattice metals, such as zinc and cadmium, when allowances were made of the differences in specific heat and freezing temperatures?

Authors' Reply

MR. LIDDIARD, replying to the discussion, said he agreed with Mr. Murphy that microporosity might be common to all alloys, and he thought the answer was that if intergranular shrinkage porosity occurred in an alloy with a very small grain, the porosity would be finely dispersed, giving micro-shrinkage or microporosity. This was a phenomenon which was not confined to magnesium. Magnesium was not particularly prone to porosity *per se*, but since magnesium base alloys usually had an extremely fine grain, shrinkage porosity was finely distributed.

With regard to the relative importance of gas, that was a subject on which a great deal of time had been spent in discussing. The position was that magnesium was obviously much less susceptible to gas pick-up and gas porosity than many other non-ferrous metals, and there was a great deal in what Mr. Murphy had said when he suggested that the effect of gas could almost be neglected, but it was all a question of where the emphasis should lie.

Although magnesium was much less susceptible to gas pick-up, it must also be remembered that precautions must still be taken to prevent gas getting into the metal. If there were carelessness in this respect and gas were allowed to get into the metal, trouble would certainly be encountered. That was the point the Authors were trying to make. There was no fundamental disagreement; it was just a question of where the emphasis should be put.

Flux as a Barrier

He apologised for his remark in introducing the Paper about the effect of flux. The point was that if the flux acted as a barrier—and many fluxes did—it could prevent either gas going in or gas coming out. In certain cases, particularly with aluminium, there was a natural barrier already there in the oxide skin and the presence of the flux might actually remove the barrier. When making his remarks about the flux he had been thinking that in the case of magnesium the flux was, in fact, acting as a barrier, because the oxide film of magnesium was not as effective a barrier as in the case of aluminium alloys, and the experimental evidence was that magnesium did not pick up gas easily under ordinary conditions of melting under a flux cover. He did not feel satisfied that that was necessarily because the solubility of the gas was low, but, as Mr. Murphy had suggested, it was possibly because the gas got in easily and also got out easily. Nevertheless, if one started off with thoroughly corroded metal there was grave danger of keeping the gas arising from the corrosion product in the metal with a much increased risk of microporosity in the resulting castings.

Referring to Mr. Miller's question as to whether it was necessary to de-gas, he hoped that his previous remarks would answer that question. Whether it was necessary to go to the extreme care the Americans apparently did, he did not know. Certainly in this country the de-gassing of magnesium was not normally considered necessary, and provided precautions to avoid gas pick-up were taken the Authors subscribed to that view.

Crystal Structure and Soundness

With regard to the remarks by Mr. Smith, Mr. Liddiard said he must take some responsibility for the suggestion that the hexagonal crystal structure of

magnesium played some part in determining the form of porosity. It was not suggested in the Paper that the annular or layer forms of porosity were due to crystal structure. Nevertheless, he thought it quite probable that the hexagonal crystals in magnesium alloys in the form of small six-arm rosettes with relatively flat sides would have a better chance of feeding than would be possible in a cubic type of structure with the arms of the dendrites growing in three directions at right angles. Porosity, whether due to shrinkage or gas, would tend to concentrate round the outsides of these hexagonal dendrites, whereas some porosity might be trapped in the growing cubic dendrites. This would account for the lower overall porosity of magnesium alloy castings and the relatively greater effect of small amounts of porosity on the mechanical properties. That was pure theory and the Authors had no experimental evidence to support that view. Some early work had been done on cadmium and zinc and the conclusion reached that the porosity in the castings which were then made was very much less than was expected. In these early experiments, however, the same care was not taken to ensure that the solidification conditions were exactly the same as in the magnesium castings, and the solidification conditions might have been more favourable in the zinc and cadmium castings. The point was, however, of great academic interest and it was hoped to carry out some experimental work on this suggestion.

Possible Effect of Gas on Microporosity

MR. BAKER, replying to some other points raised in the discussion, said the two main points he wished to amplify related to gas and its possible effect, and the question of upward feeding. The Paper expressed the possibility that gas might have some effect, merely as a precaution and warning, because in the laboratory it was shown quite definitely that if hydrogen were present in the melt it would increase the amount of microporosity. He thought, therefore, that the emphasis which had been laid on the possible effect of gas on microporosity was justified. Nevertheless, there was no direct evidence of actual trouble in that direction in practice. Reports from industry indicated that when gassy metal occurred, as evidenced by gas bubbles expelled from the freezing metal, the gas could be removed by stirring with flux at low temperatures. It was important to note that the gas effects described in the Paper were due to small amounts of gas which were not removed from the metal by such treatment.

In reply to Mr. Miller's question as to whether gas in magnesium tended to distribute porosity more uniformly, as it does in some other alloys, the position was that the Authors did not make extensive tests to elucidate this. However, he thought there was one important factor which might indicate the answer, *viz.*, that hydrogen appears to diffuse through magnesium much more quickly than through aluminium, and dissolved hydrogen would therefore tend to accumulate in those parts which froze last and were normally the most porous. Consequently, the gas would be less able to distribute the porosity more uniformly. He had no definite evidence of that, but there was experimental evidence available indicating that hydrogen diffused through a magnesium test-bar with extraordinary speed such that in the case of a test-bar with a small head just big enough to eliminate shrinkage porosity there would be marked gas porosity, whereas in a similar bar with a larger feeder head, poured from the same pot of gassy metal, no gas effect could be detected.

Influence of Atmospheric Pressure

With regard to upward feeding, he agreed that stress should be laid on the influence of atmospheric pressure because that was one of the most potent factors which facilitated upward feeding. In fact, it was not really possible to say, from experimental evidence, whether capillary forces were stronger than atmospheric pressure. He would like to add a word of caution on this question of upward feeding. One speaker had said he preferred downward feeding, and the Authors agreed that where practicable that was the better procedure. Where upward feeding was resorted to, however, the downgate must be of sufficiently large section to ensure that it remained liquid until the casting had a solid skin round it. Thereafter atmospheric pressure could be relied upon together with capillary forces to promote upward feeding and make a good casting.

With regard to the possibility of mould reaction in die casting, mentioned by Mr. Tipper, on the evidence given it was not possible to offer a strong opinion as to the cause of the porosity. It seemed likely, however, that freezing would have been too fast to allow much gas absorption to occur, and he was inclined to agree with Mr. Tipper that the cause of the porosity encountered was bad feeding.

The Authors were cordially thanked at the conclusion of the discussion.

EIRE IRON AND STEEL IMPORTS

For the first eight months of this year Eire imported iron and steel and manufactures thereof to the value of £1,015,604, as compared with £676,429 for the corresponding period of last year. The August figure was £230,927, against £63,471. Leading figures for the eight months period were:—Pig-iron, £16,212 (against £16,918); iron bars, £6,035 (£46,237); steel bars, £106,456 (£28,291); iron and steel manufactures, fabricated, £14,082 (£1,075); manufactures, not fabricated, £39,032 (£6,175); squares and flats of iron and steel, £44,973 (£13,978); plates and sheets, not coated, £38,749 (£17,678); wrought iron or steel tubes, etc., £38,625 (£29,674); cast-iron pipes, £30,780 (against £7,679); wire manufactures, £16,771 (£3,856); railway material, £20,813 (£9,604); tanks, cisterns, etc., £4,600 (£713); hollow-ware, £34,447 (£20,625).

Imports of non-ferrous ores, metals and manufactures totalled for the same period £302,163, against £98,679, the August figure being £95,234, against £11,225.

UNIFICATION OF ENGINEERING STANDARDS

RESULTS OF OTTAWA CONFERENCE

The conference on the Unification of Engineering Standards, held under the auspices of the Combined Production and Resources Board, has adjourned after a two-week session which brought together many notable engineers of the United States, the United Kingdom and Canada.

During the course of the discussions, which included screw threads, pipe threads, drawing practice, metrology, and limits and fits, a solid basis for agreement was reached on many aspects of these technical problems. It is anticipated that proposals on specifications will be developed on the basis of agreements reached by the delegates through the normal machinery which exists in the various countries for this purpose.

The fundamental differences between British and American screw-thread forms, which caused many production and supply difficulties during the war, were resolved to the point where the delegates were prepared to return to their respective countries with a specification for a basis thread form that would provide a unified standard for all countries employing the inch system.

This basis form retains the best features of the present forms, and at the same time a series of associated diameters and pitches has been worked out which, it is believed, will simplify existing practice and yet provide an adequate range of choice for all general requirements. It is also felt that the proposed change would involve the minimum amount of departure from existing practice consistent with the obtaining of a common standard for general-purpose threads to the inch system of measurement.

The proposal on a basic thread form was by far the most outstanding accomplishment of the conference, and exemplifies the spirit of collaboration that prevails among the engineering professions of the three countries.

Acme Threads

Hardly less noteworthy is the agreement reached at the conference on acme and sub-acme threads. This type of thread is extensively used on aircraft, machine tools, and other mechanical devices, where a traverse motion is required. While these specifications still have to be submitted to industry in America, Britain and Canada through national standards bodies, the conference feels certain that what they term "an ABC standard" will be speedily approved.

Mutual understanding was reached on specifications for small screws, such as are used in watches and clocks. An understanding was also reached on threads for microscope lenses, and it was decided that steps should be immediately taken to write unified standards for all threaded parts for cameras, including the screw thread for mounting on tripods. Agreement was reached on a specification for fine motion screw threads such as are employed in micrometers.

The greatest spirit of co-operation was shown by the delegates of the three countries and plans further to resolve differences in specifications for various screws used in optical, electrical and scientific instruments are already under way.

In what might be termed special thread forms, the delegates reached an understanding on certain specification aspects of the buttress thread form, which is used extensively on airplane propeller hubs and in other applications where stresses are in one direction only.

Considerable progress was made in the assembling of engineering data on high-duty studs in light alloys, but the diversity of practices, particularly between Great Britain and the United States, made it impossible to formulate definite recommendations for a unified practice. The consensus of opinion of the engineers present was that a great deal of exploratory work was required. In this field the difference in drawing practices between the countries, especially the U.K. and the U.S.A., have caused much difficulty during the war. Discussions between Great Britain and the United States were initiated a year ago, and since then a considerable exchange of data has taken place. A number of delegates mentioned delays of up to a year spent in re-drawing such equipment as bomb sights, and Bren and Bofors guns, which were designed in one country, but required to be manufactured in another. Reference was again made to the problem of manufacturing the Merlin Rolls-Royce engine in the United States.

Drawing Practice

The conference's discussions on drawing practice were exploratory, but considerable data were exchanged, and it was unanimously recommended that the subject should be pursued actively with a view towards unification of practice.

The meeting on pipe threads, while not conclusive, resulted in an invitation to British and Canadian representatives to continue discussions at the convention of the American Petroleum Institute in November. This invitation will also be extended to valve and fitting manufacturers, and other interested parties.

In somewhat the same category was the subject of limits and fits in engineering. While this subject has been studied in the three countries during the last two years, only partial agreement was obtained, due to the highly technical aspects of the problem, coupled with the rather diversified practice to which each country is committed. It was decided, however, that further discussions toward reaching a more complete agreement were desirable and a meeting on this subject has been scheduled to take place in New York before the return of the British delegation.

Practices in precision measurement and gauging methods were included as a separate item on the agenda for the first time. Outlines of progress made in precision measurement were presented, and suggestions were made which it is hoped will ultimately lead to the co-ordination of practices. Data were also offered which outline proposed specifications for screw threads and connection details for gas cylinders.

The British delegation, numbering 15, plan to visit various industrial centres in Canada and the United States, and are expected to leave on their return journey towards the end of this month.

WEST RIDING OF YORKSHIRE BRANCH

DISCUSSION ON PRIZE-WINNING PAPERS

Joint discussion on two Papers, "The Modern Specialised Foundry," by William Jones (THE FOUNDRY TRADE JOURNAL, *October* 18) *and "Methods of Production in the Post-war Foundry," by William Peacock* (THE FOUNDRY TRADE JOURNAL, *October* 25), *read before the West Riding of Yorkshire branch of the Institute of British Foundrymen. The Papers were joint winning entries for the S. W. Wise memorial prize. Mr. J. Timbrell presided.*

The CHAIRMAN said anything that would take out needless labour must be an advantage. Complete mechanisation seemed to be the modern idea, but as a craftsman, with long experience of older methods, he was not sure whether it might not be possible to over-mechanise.

MR. H. FORREST, agreeing with Mr. Timbrell that there might be a possibility of over-mechanisation so far as concerned the general jobbing foundry, said that where castings were required in fairly large quantities, there seemed no reason why there should be any limit to mechanisation. Any work that lent itself to a standard box equipment which could be designed for the same job day in and day out was open to any amount of mechanisation, but where a foundry was making a mixing of castings the position was more difficult. There was little doubt that the foundry industry had been driven to increased mechanisation through war conditions, both by shortage of manpower and by the demand for vast quantities of a repetition character, and people were coming to realise that in a general way the foundry, no less than the machine shop, required some mechanical aids to keep up with modern needs.

Scope for the Apprentice

MR. W. ANDERSON asked whether the Authors would care to offer an opinion as to what better scope, if any, the mechanised foundry might afford the apprentice than the non-mechanised type.

MR. W. JONES, in reply, said the lad leaving school was looking for a cleaner kind of job, and in the mechanised foundry there could be a very high standard of control and a tight inspection. A lad who could make cores to the requirements of the mechanised foundry could satisfy any type of shop. In the mechanised foundry the training of the young man was even higher than in the ordinary general foundry.

MR. A. S. WORCESTER (past-president) reminded his audience that there were many requirements needed from the foundry, especially in an area like the West Riding of Yorkshire, which were not called for on the mass-production scale, but which formed the bulk of the business for the more general foundries. Textile valves and the like were ordered by the dozen or less—certainly not by the thousand.

MR. JONES said that, after visiting several local jobbing foundries, he was of opinion that in practically every case he had noticed operations lending themselves to improvement by mechanical aid, even if they were only in the direction of improved hygiene. There was no type of foundry which could not at least instal modern lavatory facilities. There was too much manhandling of boxes and moulds, where in many cases conveyors could be installed, and in some cases larger machines could be installed to advantage.

MR. WORCESTER stressed the error of imagining that the mechanised foundry was the only one providing good working and hygienic conditions.

MR. W. G. THORNTON, agreeing with Mr. Worcester, said that the mechanised foundry, good as it was in so many ways, could never have been created except on the basis of the personnel and experience from the older type of foundry. He would suggest that one was dependent on the other.

An Engineering Machine

MR. TUCKER said he could hardly agree with Mr. Thornton. The mechanised foundry, he suggested, was itself an engineering machine, devoted primarily to repetition requirements, and it did not really need old-type foundry experience to carry out its work, except, of course, the old rule of common sense. The mechanised foundry could easily go wrong unless adequately controlled. Absolutely no welding was allowed, for instance. These foundries had to compete with keen rivalry from other forms of product for repetition jobs and one could see that rivalry increasing as plastics developed. The introduction of vent wires and similar gadgets which involved delay could not be allowed, for the time factor was important in the mechanised foundry. The reduction in time involved in production had enabled the price to be brought down in competition with other products. But there were things the jobbing foundry also could do to improve itself. Surely any foundry worth its place could, for instance, have a sandmill, and there were other features of the mechanised foundry which he felt any ordinary foundry could instal with advantage. The old-type foundrymen had suffered from a lack of knowledge, though the Institute had gone a long way to alter that in recent years, but the ordinary jobbing foundry did not get away sufficiently from what he would call "the moulder's complex"—that is, to ram sand. The two Authors had presented a very good case for the mechanised foundry, and he believed that that type of foundry had a bigger future than the jobbing foundry unless the latter type improved itself very much.

MR. JONES, replying to Mr. D. W. Hammond, said one could not hope to put the whole of the features of a mechanised plant into a general jobbing foundry, but one could put some of the features into any of them.

MR. TUCKER asked whether it would not be possible to bring about some rationalisation of the jobbing industry by a system under which one foundry would specialise in certain directions and others in other lines, instead of all making a few of everything. He thought that would have to come.

MR. FORREST said, in his own case, they had a fairly wide range of weights and they ran four cupolas every

day and had a number of different mixtures on two of them to cater for quite a wide range of metal, and they had to have different sand for different jobs. Many jobbing foundries had a similar system. Nevertheless, Mr. Forrest said he agreed with Mr. Tucker as to the tendency towards more rationalisation even among jobbing foundries. The large engineering shop was developing into the specialised shop, and he felt it was likely the foundry industry would have to follow the same lines.

MR. G. W. NICHOLLS said the important factor to be met was that the industry must produce castings to closer tolerances. Engineers were demanding much greater accuracy, and that meant control of methods more than mere mechanisation.

Value of the Patternshop

MR. SORSBY, referring to the patternshop, which one of the Authors had alluded to as the greatest overhead expense of the foundry, said he could not agree with that suggestion. The foundry would be in a sorry plight without the patternshop, and especially the mechanised plants with their demand for exactness. As to plastics as a competitor with the iron-foundry for rainwater gutters, pipes, etc., he thought that was looking rather a long way ahead, because plastics in the immediate future were too expensive for such applications, and it was questionable how far they would ever withstand extremes of heat and frost by comparison with castings. The patternshop could obviously do with developing. The engineers demanded more from the foundry and the foundry demanded more from the patternshop, and the pattern-maker was now expected to make metal patterns, and up to the present he was rather lacking the tools to meet this new development.

After a vote of thanks to the Authors had been carried, on the proposal of Mr. J. Stott, and seconded by Mr. J. W. Hodgkinson, the chairman closed the meeting.

BOOK REVIEW

"It Can Now Be Revealed." Published by the British Railways' Press Office. Sold from all bookstalls. Price 1s.

This booklet certainly is a revelation, for whilst those of us who have travelled much during the war well realised the Herculean efforts made by the transport section of the railways, but few were cognisant of the enormous amount of munition work done in their workshops. Much additional information is given as to how the railways fought—not without serious casualties—the V-bomb raids. Finally, there is a partial disclosure of the plans for the future. This book is excellent value for money.

THE PROFESSIONAL ENGINEERS' APPOINTMENTS BUREAU, organised by the Institutions of Civil, Mechanical and Electrical Engineers, has been opened at 13, Victoria Street, London, S.W.1. Mr. R. W. L. Harris, B.Sc., has been appointed registrar and secretary. Its activities are confined to giving service to members of the sponsoring Institutions.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

570,538 CRUICKSHANK, LIMITED, R., OLLARD, E. A., and POTTS, S. Apparatus for use in electrically or otherwise treating the surfaces of metal or other articles.

570,565 SOC. ANON. DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Extracting bismuth from alloys.

570,570 BIRMINGHAM ELECTRIC FURNACES, LIMITED, LOBLEY, A. G., and HANCOCK, P. F. Nitriding processes.

570,575 ATKINSON, J. S., and STEIN & ATKINSON, LIMITED. Tunnel-type bogie furnaces.

570,641 BEECH, A. S. Foundry moulding machines.

570,671 STEWARTS AND LLOYDS, LIMITED, and MCMINN, E. Improved joint for tubes, rods and like cylindrical members.

570,681 STANDARD TELEPHONES & CABLES, LIMITED, and GILLIVER, G. Electrically welding metals.

570,689 HOBBS, J. Nozzles for metal-cutting torches and the like.

570,719 GOLDSCHMIDT, V. M. Moulds for casting metals.

570,727 LANGLEY ALLOYS, LIMITED, EVANS, F. C., and RICHARDSON, W. H. Copper base alloys.

570,729 BRAYSHAW FURNACES & TOOLS, LIMITED, BRAYSHAW, S. N., NEWMAN, F. C., and RUSHTON, F. Furnaces for the heat-treatment of metal articles.

570,749 SCOTT, L. B. Means for repairing metal castings, forgings, etc.

570,906 MILLER, G. L., and MUREX, LIMITED. Aluminium alloys.

570,953 SULZER FRERES SOC. ANON. Sand moulds for steel castings.

570,971 CADDY, S. C. Case-hardening of iron and steel.

570,979 HAMMOND, D. W., and CLOUGH, S. G. Bonding agent for foundry oil-sand cores or moulds.

U.K. CONSUMPTION OF LEAD

United Kingdom consumption of lead by main trades during the first half of 1945 was as follows:—Cable, 18,615 tons in the first quarter and 19,511 tons in the second quarter; battery (excluding oxides), 7,296 and 6,726 tons; oxides and compounds, 12,354 and 12,789; white lead, 4,470 and 4,791; sheet and pipe, 14,381 and 15,487; ammunition, 4,053 and 2,530; foil and collapsible tubes, 2,274 and 2,009; solder, 2,176 and 2,514; alloys, 1,811 and 2,736; miscellaneous uses, 2,127 and 3,108 tons.

The totals for all trades were 69,557 tons in the first quarter and 72,201 tons in the second quarter, made up of:—Imported lead and lead bullion, 51,517 and 55,265 tons; scrap lead (including lead refined in the U.K. from scrap and home-produced ores), 18,040 and 16,936 tons.

BRITISH IMPORTS OF IRON AND STEEL

PURCHASES ABROAD DURING THE WAR YEARS

The following table, extracted from Board of Trade returns recently published, gives details of British imports of iron and steel and manufactures of iron and steel during the war years. Figures of 1938 imports also are given.

	1938.	1939.	1940.	1941.	1942.	1943.	1944.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Pig-iron	395,137	354,395	675,968	971,477	356,173	361,846	285,018
Ferro-alloys, etc.—							
Ferro-chromium	10,486	14,717	19,595	27,298	17,090	28,254	11,274
Spiegeleisen and ferro-manganese	2,878	4,438	4,458	2,428	2,705	3,888	84
Ferro-silicon and silicon and alloys thereof	24,600	36,280	55,182	49,034	38,337	88,392	34,646
All other descriptions	9,631	17,174	14,981	21,108	9,309	14,501	9,569
Ingots, other than of special steel	22,608	23,505	488,153	561,543	480,442	498,095	298,023
Blooms, billets and slabs, other than special steel	315,016	369,893	1,254,258	1,362,295	884,209	845,753	692,550
Iron bars	10,696	9,163	3,046	6,634	2	1	—
Sheet bars	33,606	432,781	262,036	209,513	25,588	28,035	1,705
Wire rods	60,032	66,316	150,623	118,213	118,284	132,311	90,864
Other steel bars and rods	102,921	100,680	102,082	164,892	76,238	80,993	36,500
Ingots, blooms, billets, slabs, bars and rods of special steel	4,512	4,404	79,101	230,037	304,207	188,214	18,608
Angles, shapes and sections	44,960	42,104	104,107	81,285	815	6,897	453
Castings and forgings in the rough or machined	3,734	2,137	1,247	380	26	19	—
Girders, beams, joists and pillars	60,134	51,266	69,985	18,651	27	7,058	—
Hoop and strip	48,983	58,537	26,095	46,923	5,415	34,125	28,376
Plates and sheets—							
Not galvanised, not tinned, etc.	71,598	88,471	196,087	180,085	24,096	319,050	136,295
Coated	578	36,488	11,269	1,293	145	1,957	418
Tubes, pipes and fittings—							
Cast, including fittings	980	760	2,651	4,137	748	1,020	1,549
Wrought tubes and pipes	22,881	24,279	12,957	45,568	53,303	117,450	48,998
Fittings for wrought tubes, etc.	2,441	2,505	597	407	240	4,521	544
Railway, etc., material	20,394	13,413	96,481	18,077	75,726	15,287	21,065
Wire (except insulated wire)	12,469	17,189	20,374	11,998	23,410	14,664	18,063
Wire nails, tacks and staples	18,338	15,720	6,108	2,682	656	80	16
Other wire manufactures	3,294	2,758	584	2,142	93	355	1,431
Nails, tacks and staples (other than wire nails, wire staples and insulated staples), rivets, washers, wood screws, etc.	5,238	4,764	1,834	264	449	569	13
Bolts, nuts and metal screws	7,110	5,565	12,399	5,260	3,560	2,976	1,698
Stoves, grates and ranges	840	574	180	44	75	68	43
Baths	7,543	5,075	8	—	—	—	—
Hollow-ware	3,723	2,316	804	33	8	6,003	6,244
Other manufactures of iron and steel	16,909	13,607	15,878	33,636	8,041	9,303	19,783
Total	1,344,270	1,821,274	3,689,128	4,177,337	2,509,417	2,811,685	1,763,830

HIGH-SILICON IRON CASTINGS

A further specification in the STA series for high-silicon iron castings (STA/25) has been issued by the British Standards Institution. The specification includes details of the chemical composition of the material and also requirements relating to heat-treatment, welding, hydraulic testing, etc. This material, which has a silicon content of approximately 14.5 per cent., is used for special pipe work involving the use of acids.

ASSOCIATED EDGE TOOL INDUSTRIES, LIMITED, is being wound up voluntarily. Mr. P. F. Carpenter, of W. B. Keen & Company, 224, Regent Street, London, W.1, is the liquidator. The liquidation is for the purposes of reconstruction only.

Standard samples for analytical purposes may be obtained from the National Physical Laboratory, Teddington, Middlesex. Copies of the specification are available from the British Standards Institution, 28, Victoria Street, S.W.1. (Price 6d.)

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

NOVEMBER 9.

Institute of Welding (Birmingham branch):—"Review of the Application and Development of Oxygen Cutting," by R. Dore. At the James Watt Memorial Institute, Great Charles Street, Birmingham, at 6.30 p.m.

Institution of Mechanical Engineers:—"Elementary Principles of Plant Organisation and Maintenance for Civil Engineering Contractors," by H. O. Parrack. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

NOVEMBER 12.

Association of Bronze and Brass Founders:—Yorkshire area meeting. At the Great Northern Hotel, Leeds, at 12.30 p.m.

NOVEMBER 13.

Institution of Chemical Engineers:—Joint meeting with the Chemical Engineering Group. "Some Practical Aspects of Large-scale Gas Distribution, with Particular Reference to Steelworks," by E. Hemingway Jones. At the Geological Society, Burlington House, Piccadilly, London, W.1, at 5.30 p.m.

NOVEMBER 14.

Institute of Welding (Eastern Counties branch):—"Training of Welding Inspectors," by C. W. Ephithite. At Ipswich.

Institute of Welding (West Scotland branch):—"The Use of Welding and Riveting in Shipbuilding," by G. Roberts and J. F. Morton. At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.

Institute of Welding (North London branch):—"Welding Construction and the Drawing Office," by H. V. Hill. At Enfield Technical College, Queensway, Enfield, at 8 p.m.

NOVEMBER 15.

Association of Bronze and Brass Founders:—Midland area meeting. At the Station Hotel, Stoke-on-Trent, at 1 p.m.

Institute of Welding (Eastern Counties branch):—"Training of Welding Inspectors," by C. W. Ephithite. At Colchester.

NOVEMBER 16.

Institution of Mechanical Engineers:—Thomas Hawksley lecture, "The Scientist in Wartime," by Sir Edward V. Appleton. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

Keighley Association of Engineers:—"Industrial Automatic Control," by F. Blezzard. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Manchester Association of Engineers:—"Developments in Textile Finishing Machinery," by K. S. Laurie. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

NOVEMBER 26.

Association of Bronze and Brass Founders:—Scottish area meeting. At the Grosvenor Restaurant, Glasgow, at 1 p.m.

Institute of British Foundrymen

NOVEMBER 10.

Lincoln section:—"Consistency and the Cupola," by C. A. Payne. At Lincoln Technical College, at 2.45 p.m.

Newcastle branch:—Visit to the Consett Iron Company, Limited, Fell Coke Works, Consett. Short Paper on steelmaking, by an official of the company, at 2.30 p.m.

Scottish branch:—Joint meeting with the Iron and Steel Institute. "The German Steel Foundry Industry," by Basil Gray. At the Royal Technical College, George Street, Glasgow, at 3 p.m.

West Riding of Yorkshire branch:—"Steelfoundry Sand Practices," by R. Foster and H. Stoker. At the Technical College, Bradford, at 6.30 p.m.

NOVEMBER 17.

East Midlands branch:—"A New Method of Investigating the Behaviour of Charge Materials in an Ironfoundry Cupola and Some Results Obtained," by N. E. Rambush and G. B. Taylor. At the Technical College, Leicester at 6 p.m.

Wales and Monmouth branch:—Visit to the Glanmor Foundry Company, Limited, Llanelly. "Gating and Feeding of Steel Castings," by S. T. Jazwinski, E. D. Wells, and S. L. Finch, at 2.30 p.m.

NOVEMBER 19.

Sheffield Society of Engineers and Metallurgists:—"Aero Engines, 1915-1945—Some Personal Impressions," by Major G. P. Bulman. At the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

NOVEMBER 24.

Bristol branch:—"Duplex Pump Castings," by Brown and Dewhurst. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

Falkirk section:—"Enamelling and Protection Finishes for Cast Iron," by W. W. Shaw. At the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

NOVEMBER 26.

Sheffield branch:—"The Technological Principles of Casting Design," by Prof. V. M. Shestopal, presented by W. H. Salmon. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

NOVEMBER 28.

Birmingham branch:—Short Papers on "Economical Quick Methods of Preparing Plate Patterns for Limited Quantity Production." At the James Watt Institute, Great Charles Street, Birmingham, at 7.30 p.m.

London branch:—"The Technological Principles of Casting Design," by Prof. V. M. Shestopal, presented by C. H. Kain. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

NOVEMBER 29.

Institute of Vitreous Enamellers:—Annual meeting commences. (For details see our issue of October 18.)

BEHAVIOUR OF CHARGE MATERIAL

(*Continued from page* 204.)

stretch right across the diameter at the tuyere level and for some 15 to 18 in. upwards, while later it will be forced to move towards the centre at the tuyere level, and above this its shape will alter from a cylindrical one to that of a cone, the location of which will to some extent depend upon the relative resistance of various parts of the charge above.

It was hoped to produce positive proof of the belief that the wear of the daubed lining above the tuyeres is due purely to the effect of heat (in the presence of the molten slag and iron), but this has not been possible. Nor can it be said whether this wear takes place mainly at the beginning of the heat when there is no "slag ledge" forcing the air blast up through the centre rather than along the inner wall of the lining. Further research on this problem is, however, continuing and both methods and materials involved in the original lining and the daubing are being examined.

In all the tests it has been noted that the passage of the water and steam through the burden appears to have no deleterious effect on the brickwork of the furnace lining. Indeed, relining other than the usual daubing with ganister and firebrick has been found to be unnecessary, although on putting the cupola into operation again, special precautions should be taken to ensure that both lining and insulation bricks are thoroughly dried out.

(*To be continued.*)

Save Fuel
IN YOUR CUPOLAS
BY USING
STANTON
SAND-LESS
MACHINE CAST
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED
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NEWS IN BRIEF

VICKERS-ARMSTRONGS, LIMITED, have received an order from the P. & O. Company to build a liner of 29,000 tons.

LYDHOLME ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. C. H. Bryant, St. Stephen's House, Victoria Embankment, London, S.W.1, is the liquidator.

THE TELEPHONE NUMBER of Wallwork Gears, Limited, 157, Victoria Street, London, S.W.1, is Victoria 0482 and not as stated in their advertisement on page 16 of our last issue.

THE REGISTERED OFFICE of the British Iron & Steel Corporation, Limited, is now 7, Park Lane, London, W.1. Correspondence previously sent to Warwick Castle, Ashorne Hill, or Steel House, London, should be sent to the new address.

MR. GEORGE BUCHANAN, Joint Parliamentary Under-Secretary for Scotland, recently opened at Dumbarton the first aluminium house to be built in Scotland, which will probably have 12,000 of this type out of the 34,000 temporary houses allocated to it.

THE REGIONAL PRODUCTION BOARDS have now been reconstituted by the President of the Board of Trade as regional boards for industry. The boards will in future exercise their activity over the whole field of productive industry, instead of, as in the past, being chiefly concerned with the production of munitions.

RENFREW FOUNDRIES, LIMITED, a company formed by Col. W. C. Devereux and Rolls-Royce, Limited, have acquired the famous Hillington foundry, near Glasgow, from the Ministry of Aircraft Production. During the war the Hillington shops employed 4,000 operatives and produced 31,440 tons of aluminium-alloy castings, sufficient for 80,000 high-performance aero engines. The obviously great resources of this foundry are now to be diverted to the production of civilian goods.

MR. F. TENVIG, a Norwegian shipbroker who has recently returned to Norway from England and America, where he was one of a mission negotiating for the supply of steel for the Norwegian shipbuilding programmes in Norway, Sweden and Denmark, stated that the matter had been arranged satisfactorily. Nearly 47,000 tons of steel had been bought in America for shipment this year, while about 70,000 tons, bought in England, would be shipped between now and next June.

PLANS TO DEVELOP the export of British precision steel tubes, particularly in the European, South American, and Eastern markets formerly held by Germany, have been put into operation by the Tube Investments group of engineering industries. To ensure equal opportunity in these highly competitive markets, a programme of re-equipment and plant assembly, involving an ultimate expenditure of some £1,500,000, has been started at the group's steel tube mills in various parts of the country.

A £200,000 EXPENDITURE PROGRAMME on new equipment, to establish their Simplex-Creda electrical appliances works at Oldbury, near Birmingham, on a basis of the highest productive efficiency, is announced by Tube Investments, Limited. Mr. A. G. E. Briggs, formerly Deputy Steel Controller, and recently elected to the board of Tube Investments, Limited, as assistant managing director, is in charge of the developments, which will not interrupt existing production. The plan will result in an increased supply for the home market of electric cookers, fires, wash-boilers, kettles and irons, etc.

A SUGGESTION THAT the two sides of the steel industry should confer with a view to raising the efficiency of ingot production and saving fuel is contained in the October issue of "Man and Metal," the organ of the Iron and Steel Trades Confederation. Pointing out the need for a higher output to aid the export drive, the article recalls a series of conferences with the employers in 1938-39 at which the representatives of the steelworkers urged the reorganisation of working hours in the melting shops. The proposals, the article continues, were not adopted at the time and the outbreak of war put an end to the discussions.

THE GOVERNMENT have decided that inventions made in Germany since September 3, 1938, shall not be allowed to form the basis of valid applications for the grant of patents, or for registration of designs in the United Kingdom, and accordingly such applications will not be accepted by the Comptroller of the Patent Office. Any rights lawfully acquired by non-enemies before September 3, 1939, in inventions for which protection was applied for in Germany in the 12 months preceding that date will be safeguarded. Any legislation or other measure necessary to give effect to this decision will be adopted as soon as practicable.

RECRUITMENT OF FOUNDRY LABOUR

The Ministry of Labour and National Service have set up a committee, the terms of reference of which are "to examine any individual scheme put up for the recruitment of labour for the foundry industry." The following is the constitution of the committee:—Mr. H. B. Clark, O.B.E. (chairman), Mr. C. J. Payne, M.M. (secretary), both Ministry of Labour officials: nominees of the Joint Iron Council and the Engineering and Allied Employers' Federation: Mr. J. W. Berry, Mr. R. B. Templeton, and Mr. A. Young, nominees of the trades unions: Mr. W. Wallace (National Union of Foundry Workers), Mr. J. H. Wigglesworth (Iron, Steel and Metal Dressers' Trade Society), and Mr. A. C. Logan (Ironfoundry Workers' Association).

The importation of French or Belgian moulders and coremakers proved to be too difficult. The report that the Minister has directed that redundant labour in the non-ferrous, including light alloy foundries, should have the option of being mobilised in the Forces of the Crown or of being employed in the ironfoundry section is neither confirmed nor denied by the officials at the Ministry of Labour and National Service.

Design by Eric Fraser

MOSAICS OF STEEL

NUMBER NINE

The utilisation of steel and concrete produced a new structural technique of far reaching importance. The immense strength of reinforced concrete relies on the quality of suitably formed steel bars embedded in the surrounding concrete. The Templeboro plant of the United Strip and Bar Mills is essentially laid out to produce enormous tonnages of varying diameter bar. The importance of the service rendered by these mills to the builder and civil engineer for re-construction work cannot be stressed too greatly as a contribution to the future.

THE UNITED STEEL COMPANIES LTD

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THE ROTHERVALE COLLIERIES, TREETON
THE SHEFFIELD COAL CO. LTD., TREETON
THOS. BUTLIN & CO., WELLINGBOROUGH

USP.53

WORK OF A.I.D. TEST HOUSE

INSPECTION TECHNIQUE

An opportunity to see the work of the test house of the Aeronautical Inspection Department of the Ministry of Aircraft Production at Harefield, Middlesex, was given to representatives of the technical Press recently. Although time was limited, the excellent arrangements made for the visit enabled the party to make a thorough tour of the many sections of the test house, the primary purpose of which is to provide facilities for check testing the work of contractors employed in the manufacture of any material to be used in the construction of aircraft or in the manufacture of component parts. Functioning tests of any instrument, whether flying, navigation, offensive or defensive, and the inspection of engineers' precision gauges used by the A.I.D. at contractors' works are also carried out. The development of inspection technique is another aspect of the work, and in certain sections this includes the designing of new test apparatus.

The central equipment and gauge stores for the whole of the A.I.D. are located at Harefield, together with the central accounts branch, and for this purpose the unit is divided into five main divisions. The materials division deals with the tests, both physical and analytical, of all classes of materials, both metallic and non-metallic, and including plastics, fuels and lubricants, also tests for defects by X-ray and other non-destructive methods. The aircraft equipment division is equipped with apparatus for carrying out check tests on all types of instruments, whether optical, mechanical or electrical. Equipment for checking and testing all types of gauges used by the inspection staff is contained in the metrology division. This section includes a small tool room equipped with a comprehensive range of machine tools where gauges are repaired or modified as necessary, and also for the manufacture of a limited number of gauges most urgently required. The maintenance section is responsible for the maintenance of all plant and all minor repairs and alterations required to any of the buildings, and also for the maintenance of all services. The fifth division deals with administration.

EXPORT OF SURPLUS MACHINE TOOLS

It has been a condition of the Government's machine-tool disposal scheme that Government surplus machine tools are not exported. The object of this has been to give British industry a first chance to re-equip itself with the best surplus tools.

The Machine Tool Control now announces that, as from November 1, Government surplus used and unused machine tools which have been on offer to British industry through the disposal scheme for four months are available for export. Details of these machines will continue to be available in the records at the disposal centres and they will be available for purchase by merchants or others engaged in the export trade.

The restriction on the export of American machine tools acquired under Lend/Lease arrangements remains in force.

PERSONAL

MR. NOEL KER LINDSAY has been appointed the first Director of the British Non-Ferrous Metals Federation. He will take up his appointment on December 1.

MR. ANTHONY H. CROUCHER has relinquished his position with Powered Mountings, Limited, to become chief engineer of Nichols-Compressors, Limited, Tolworth, Surrey.

SIR GEOFFREY PETO, Regional Controller, Southern Region, Ministry of Supply, has been released as from October 31. He was a director of the Morgan Crucible Company, Limited.

MR. J. W. RICHARDS has retired after 40 years' service as foundry manager at Beans Industries, Limited, Tipton, Staffs. He was presented with a gold watch as a memento of the occasion.

MR. R. T. TARRANT, secretary of the National Association for Rolled and Re-Rolled Steel Products, has been appointed secretary of the newly formed Light Rolled Steel Products Conference.

MR. JAMES CAMERON has retired after 35 years as secretary of the North-East Coast Engineering Employers' Association, the Tyne Shipbuilders' Association, and the North-East Coast Shiprepairers' Association.

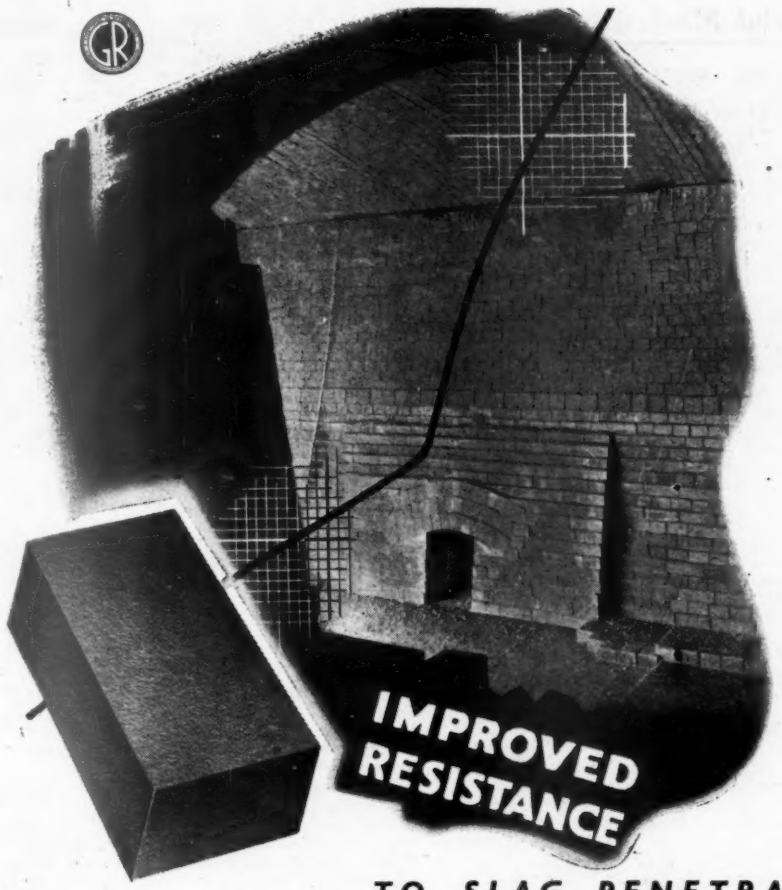
MR. ANGUS REID has been appointed general works manager of the Mossend and Hamilton foundries of the Fullwood Foundry Company, Limited. For the past 10 years Mr. Reid has been manager of the Hamilton foundry.

MR. ALLAN STEVENSON, a director of David Rowan & Company, Limited, Glasgow, has been elected chairman for 1945-46 of the National Association of Marine Enginebuilders. MR. H. E. SHEARDOWN, chairman of Charles D. Holmes & Company, Limited, Hull, is the vice-chairman.

MR. FREDERICK CHARLES WESSON, managing director of William Wesson & Company, Limited, Victoria Iron Works, Moxley, and "father" of the Darlaston Urban Council, recently had his name entered on Darlaston's Roll of Fellowship in token of his 26 years' service to the town. He was elected to the Council in 1919, and was chairman from 1926 to 1929. He was elected a member of the Staffordshire County Council in 1931, and was appointed a Justice of the Peace in 1935.

TO ADVISE ON TRADE FAIRS

Mr. Marquand, Secretary of the Overseas Trade Department, has appointed a committee to advise him on the policy and plans that should be adopted to derive the maximum advantage for the export trade from exhibitions, fairs, and other public displays. He has particularly asked for the committee's views on the suggestion that an international exhibition should be held in London in 1951 to celebrate the centenary of the 1851 exhibition.



TO SLAG PENETRATION

SLAG penetration of refractory materials normally accompanied by erosion, surface spalling, shrinkage, etc., is frequently responsible for the ultimate failure of refractories. To reduce the destructive effect of slag penetration, volume-stable, dense, low-porosity, low-permeability bricks, with the correct chemical composition, must be used. A characteristic of G.R. products is that they possess these necessary qualities and thus ensure minimum slag penetration. The services of G.R. engineers are available on request, to users, on the choice and application of refractories.

FIREBRICKS · BASIC BRICKS
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AND HIGH ALUMINA BRICKS
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Raw Material Markets

IRON AND STEEL

With the welcome ending of the dock strike, a spurt in shipments of finished steel products may be expected. Export trade was restricted at a time when foreign buyers were clamouring for steel, and there is a good deal of ground to be made up.

Pig-iron supplies have been sufficient to go round. Larger quantities, however, are needed to meet an increasing demand. Meanwhile, labour problems continue to harass the light foundries. Special grades of low- and medium-phosphorus pig-iron appear to be in slightly better supply than the cheaper, high-phosphorus brands.

In the scrap market, the strong demand is sustained, with heavy scrap in the forefront of requirements. The demand for good heavy material in furnace and foundry sizes continues to rise, and, in some instances, supply is outstripped by demand. A good market also prevails for short heavy steel for foundry use, whilst foundries are accepting all available tonnages of heavy cast-iron and first-class machinery metal. Licences for cast-iron scrap, incidentally, are now being issued to foundries fairly freely.

The position with regard to semi-finished steel is extremely tight, and available parcels of defectives and crops that can be used in the mills are readily accepted. Additional supplies are urgently required, and until these are forthcoming, the position of the re-rollers must remain precarious. Sheet mills are working at very great pressure, and have difficulty in keeping pace with their delivery obligations. Plate producers are now heavily sold.

NON-FERROUS METALS

There is no shortage of lead in this country, but it must be remembered that the demand is not strong. When the housing programme gets into full swing, the trade will show a vast improvement. Meanwhile, in America, output of refined lead is at its lowest level since 1938, the actual figure being only 27,552 short tons. This downward trend is attributed to the lack of labour at smelters. Also, from America comes the news that the Government restrictions on the use of tin are to continue at least until next June. Restrictions on tinplate, however, are to continue for three or four months only.

Current requirements of zinc in this country are met with improved labour supplies; an enlargement of the production of semi-finished and finished products would be possible, but no undue difficulties should be experienced in the provision of raw zinc. There are, apparently, very good stocks of zinc in the United States; an unofficial estimate gives America 20 months' supply.

There is little information about copper supplies and the trade is kept in ignorance of the level of Government stocks. There is no anxiety, however, about the position, especially with consumption at its present relatively low level.

According to a provisional official report, stocks of tin concentrates in Siam amount to over 16,000 tons, and of tin metal to about 4,000 tons. The state of the mines is believed to be satisfactory, and some dredges have been working.

HARDWARE AND IRONMONGERY PRICES

The Board of Trade, after consultation with the Central Price Regulation Committee, have made an Order amending the General Hardware and Ironmongery (Maximum Prices) Order, 1945, to permit manufacturers of cast-iron hollow-ware to charge revised prices. For tinned, turned, barffed or black-finished hollow-ware, manufacturers may now charge up to 13.05 per cent. above their August, 1943, prices, and for enamel-finished ware, 18 per cent. above their August, 1943, prices. The new Order does not make any changes in manufacturers' maximum prices for other goods covered by the principal Order or in the margin provisions applying to wholesalers and retailers.

The new Order, which is to be known as the General Hardware and Ironmongery (Maximum Prices) (No. 2) Order, 1945 (S.R. & O., 1945, No. 1333), came into operation on Monday last. Copies may be obtained, price 1d. each, through any newsagent or direct from H.M. Stationery Office, Kingsway, London, W.C.2.

LIGHT ROLLED STEEL PRODUCTS CONFERENCE

The new constitution of the British Iron and Steel Federation, which came into operation at the end of May, is based on membership by conferences representing manufacturers of the various products of the industry.

In accordance with the new Federation arrangements, the Light Rolled Steel Products Conference has now adopted a constitution and appointed as first chairman (for 1945) Mr. Andrew Jollie, of Steel, Peech & Tozer. Mr. G. H. Latham, chairman of the Whitehead Iron & Steel Company, Limited, is appointed deputy chairman of the conference. Mr. Latham will succeed Mr. Jollie as chairman of the conference in 1946, and Mr. John R. Hope, of the Lancashire Steel Corporation, Limited, will be deputy chairman.

THE MINISTER OF SUPPLY has agreed to the release of Mr. F. E. Smith, Chief Engineer, Armaments Design Department. He is succeeded by Commander S. S. C. Mitchell, R.N. (retd.).

A NEW FOUNDRY will shortly be set up at Inchicore, Dublin, in premises which have been acquired by Goodwin, Barsby (Ireland), Limited, of Leicester. Their principal products will be heavy road-making machinery and concrete mixers.